CFM Series

2xE1 Full Outdoor Unit

Technical Description

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1 2xE1 Full Outdoor Unit Overview

Proprietary notice

The specifications or information contained in this document are subject to change without notice due to continuing introduction of design improvements. If there is any conflict between this document and compliance statements, the latter will supersede this document.

This document briefly describes the CFM series **2xE1 Full Outdoor Unit** (also mentioned as FODU) describing the built-in management system, configuration functionality, hardware features, etc.

The CFM 2xE1 FODU provides the following interfaces:

- Two E1 traffic interfaces (G.703), 120 Ω balanced;
- RS232 serial console port: the RS232 interface providing local management functionality allowing to control and supervise the FODU from a PC via command interface (e.g., using programs like "Hyper Terminal");
- RSSI port (BNC socket) for antenna alignment adjustment: this port is used for antenna positioning;
- Alarm relay: special dry relay alarm contact group signalizes any malfunction; normally the relay contacts close the circuit, the alarm triggers (that is, circuit breaks) in case of any of the following occurrences:
    - Power supply failure;
    - Loss of frame synchronization (from far-end site);
    - Received signal level is lower the predefined value (with **RxAlarmLevel** command);
    - Humidity level too high;
    - Transmitter PLL failure.

Both RS-232 interface and E1 traffic interfaces as well as alarm relay and power supply outlet are all implemented on a single 18-pin port connector (refer to Chapter 6 for pinouts).

Revision history

Revision	Date	Comments
1.0	January, 2003	
1.1	December, 2004	

1.1 Technical data

Weight		2.5 kg
Dimensions HxWxD		∅ 280 x 85 mm
Power consumption		15 W max
Power supply		From 20 to 60 VDC (directly on input of the FODU)
Operating temperature		-33 °C to + 55 °C
Traffic interface		2xE1 balanced 120 Ω
Traffic capacity		2x2 Mbps (other capacities will be available later)
Management interface		RS-232
Traffic and management interface port connector		Type: LTWDD-18PMFP-LS, 18-pin (produced by: LTW Technology co., Ltd.) The terminal equipment is connected to the Outdoor Unit via 16-wire twisted-pair cable (see Chapter 6 for pinouts). The connector is suited for cables with the diameter from 4 to 10.5 mm.
Additional features:		• RSSI port (BNC socket) for antenna alignment adjustment; • Alarm relay (dry relay).
Radio parameters	FODU operating in 13 GHz band	Receiver thresholds at antenna port (guaranteed): BER 10^{-6}: -83 dBm BER 10^{-3}: -86 dBm Background BER (ETS EN 301 128 method): 10^{-11} Max transmit power: 20 dBm Frequency stability: +/- 10 PPM Tx power attenuation: 0 … 20 dB Waveguide flange: UBR 140
	FODU operating in 15 GHz band	Receiver thresholds at antenna port (guaranteed): BER 10^{-6}: -83 dBm BER 10^{-3}: -86 dBm Background BER (ETS EN 301 128 method): 10^{-11} Max transmit power: 20 dBm Frequency stability: +/- 10 PPM Tx power attenuation: 0 … 20 dB Waveguide flange: UBR 140
	FODU operating in 23 GHz band	Receiver thresholds at antenna port (guaranteed): BER 10^{-6}: -83.5 dBm BER 10^{-3}: -87 dBm Background BER (ETS EN 300 198 method): 10^{-11} Max transmit power: 19 dBm Frequency stability: +/- 10 PPM Tx power attenuation: 0 … 19 dB Waveguide flange: UBR 220

1.2 Termination Unit (Optional)

Along with the Full Outdoor Unit, the CFM-8-TU4E1 unit (henceforth 'Termination Unit') may be used for FODU interface termination; the unit also converts the balanced E1 signal coming from the FODU to unbalanced, providing both, the balanced 120 Ω E1 port with BNC connector and the unbalanced 75 Ω E1 port with RJ-45 socket, this unit is described in detail in Figure 1.

The Termination Unit also provides RS232 management port on RJ-45 socket.

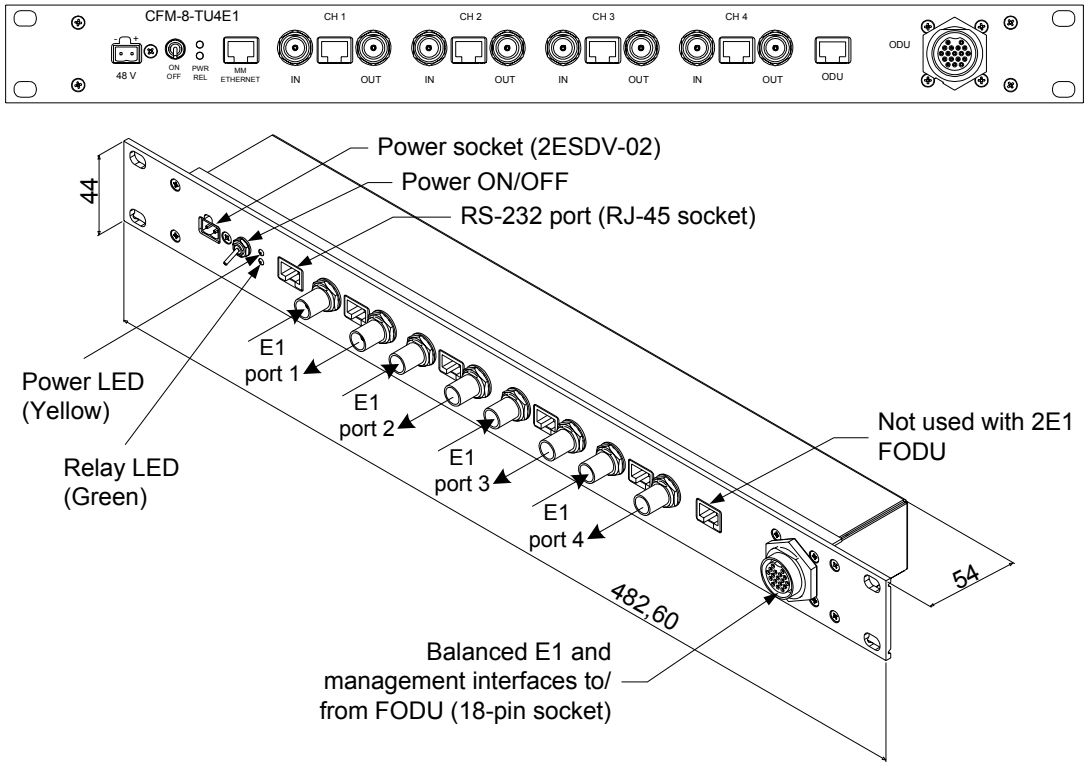


Figure 1. Termination Unit for FODU

The Termination Unit is frequency and capacity independent.

1.3 Cable Requirements

The maximum cable length from radio to the customer equipment is determined by attenuation and interference for 3 types of signal carried over the cable,

- Serial data (RS-232, ASCII terminal connection),
- Balanced E1 signals,
- Power feed for the radio,
- Alarms.

RS-232 Serial Connection

In case 5V driver is used in the connected equipment and there is no interference in the cable, the RS-232 connection will operate over at least 100 m of cable.

SAF Tehnika will guaranty the operation over at least 10 m of cable under worst case scenario as the very pessimistic estimate in case low voltage (3.3V) driver is employed for RS-232 connection from the customer side and heavy interference is experienced.

If the Termination Unit is used, for serial connection the following cable (see Figure 2) can be used to connect ASCII console to the FODU via RJ-45 socket, provided on the Termination Unit.

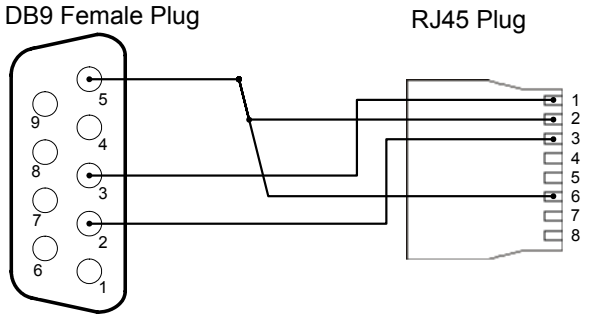


Figure 2. Serial connection cable DB9←→RJ45

E1 Connection

E1 signals will be carried properly over at least 100 m of cable.

Power Supply to the Radio

The acceptable cable length witch will provide proper operation of the system from DC power feed point of view is determined by wire diameter and supplied DC voltage, please find typical figures in the table below.

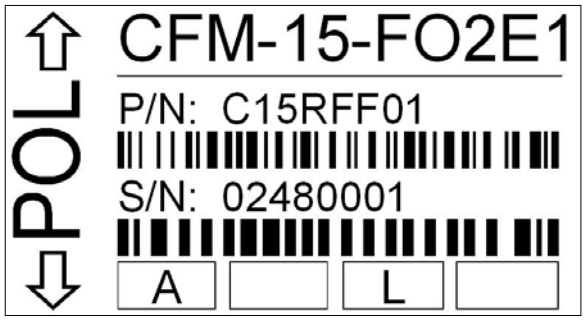
Power supply voltage	Stranded wire diameter [mm]/AWG	Max. cable length
48 VDC	0.5 mm/24 AWG	100 m
24 VDC	0.5 mm/24 AWG	20 m

In order to provide proper sealing between the cable and the connector, the cable must have a diameter of the outer jacket from 4 to 10.5 mm with a minimum wire diameter of 0.5 mm (24 AWG).

1.4 Labelling

The depicted label contains the following information (see sample in the picture below):

- Polarization direction (↑ ↓ POL);
- Model type ("CFM-15-FO2E1");
- Model part # (C15RFF01);
- Unit serial # (02480001); Combined model part # + Unit S/N produces unique identifier for particular Unit;
- Subband identifier A or B (first 2 leftmost boxes) if appropriate for particular frequency band and channel plan;
- Tx High or Low designation (L or H in 2 rightmost boxes)



2 Management Interfaces

2.1 RS-232 Serial Port

RS-232 serial management port of the IDU will provide terminal management via connected PC or other terminal device or modem.

The terminal connected to the RS-232 serial interface is referred to as the ASCII management console (or ASCII console) and provides the management functionality available via Command Line Interface described in Chapter 2.3.

2.2 Connecting to the RS-232 port

To connect the console to the Radio via RS-232 interface, please refer to Chapter 6 for pinouts; the serial port of the management console should be configured as 9600 8-N-1, no data flow control.

Note: when connected for the first time, the CLI management software starts sending basic Radio status information to the console. This Radio status information will be displayed on the terminal window of the console and the information displayed may *flicker*. This is because the Radio status information is periodically updated, to turn off this auto update type update off and press *Enter*. If this command is properly entered, the auto updating (and flickering) will stop. The auto update can be turned on using update on command.

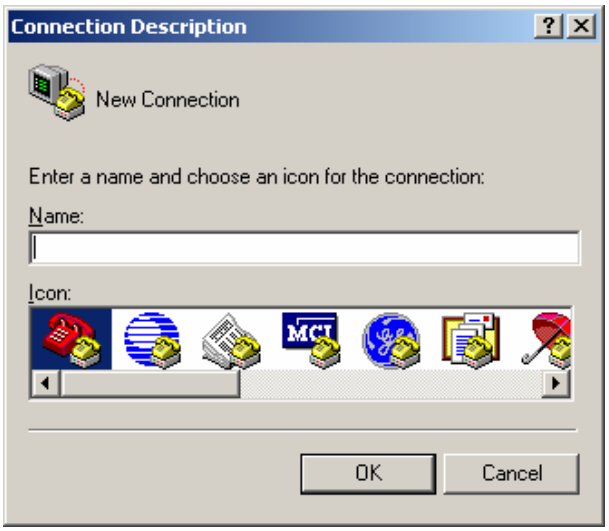
If using modems, the management terminal is connected with the Radio remotely through a telephone line. In this case the modem, *which is connected with the IDU*, should be configured as stated below:

- Auto answer on first ring ON
- Echo offline commands OFF
- Suppress result codes
- DTR override

The modem configuration then should be saved (typically with AT&W string).

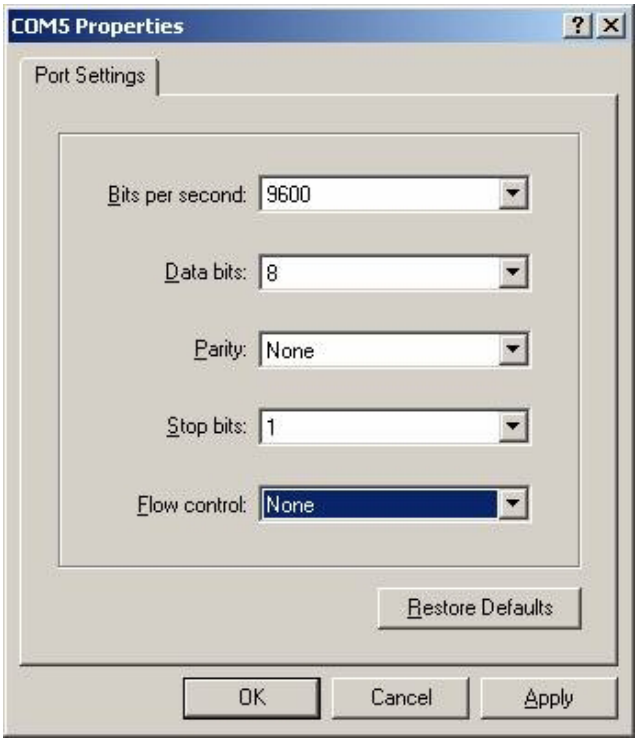
In order to connect the PC to the RS232 management port using *Hyper Terminal* program (this program is included in any Windows version), proceed as described below.

1. Connect PC to the RS232 serial port by means of "straight through" or modem serial cable (null-cable).
2. Run "Hyper Terminal" program.
3. Make a *New connection*, enter connection name.



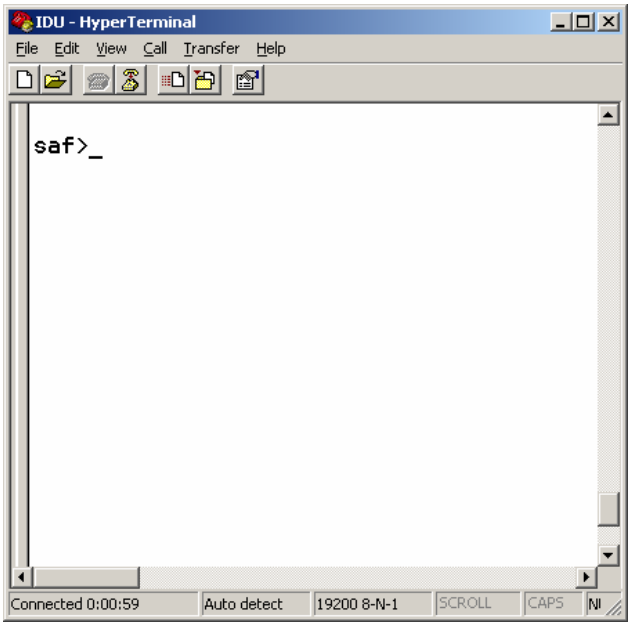
4. Choose port (COM1 or COM2).

5. Set port settings (bits per second: 9600, data bits: 8, parity: none, stop bits: 1, no data flow control).



6. Press OK
7. Press Enter. Password is disabled by default.

If successfully connected, the prompt should appear as in the picture below. You are connected to IDU. See Chapter 2.3 for available commands.



2.3 Command Line Interface for ASCII Consoles

The command line management interface offers the widest configuration and monitoring functionality. The following tables summarize all available commands for ASCII management terminals.

Note: There are more commands available than those listed below, but these are for development purposes only, - not applicable for users therefore not documented.

Command	Description
wdttest	Restart the ODU
BBloop {on | analog | off} [*duration*]	Set baseband loopback, "on" – set digital loopback (dual), "analog" – set analog loopback (non-dual), "off" – suspend baseband loopback; see Chapters 5.2 and 5.4 for more info.
RF loop {on | off} [*duration*]	Set RF loopback, - "on" – set loopback, "off" – suspend loopback; see Chapters 5.1 and 5.4 for more info.
RxAlarmLevel <*alarmLevel*>	Set the Rx signal level at which the Radio Alarm is switched on.
Channel <*channel#*>	Set the ODU Tx and Rx frequency. Channel numbers and their corresponding Tx/Rx frequency values are found in the document "*Channel plans*".
Txpower {-10|-9|…|0|+1|+2|…|+20 |off}	Set the ODU Transmitter power [dBm]. The default setting is "OFF".
Info	Returns product information: product name, product code, product type, information about channel plan and other.
e1 {1 | 2} **loop** {analog | digital | remote | off}	Set on/off E1 interface loopback, the following loopbacks are available: analog, digital, remote. Example: E1 1 loop digital The analog and remote loopback is not dual; the digital loopback is dual; see Chapters 5.3 and 5.4 for more info.
e1 {1 | 2} **stat**	Return the E1 interface status, example: E1 2 stat LOS ON Analog loopback OFF Remote loopback OFF Digital loopback OFF Bipolar violations OFF AIS ON
Astats	Show radio parameters (displays current Tx power, alarm and relay status)
Stat	Show radio and E1 interface parameters (displays current Tx power, alarm and relay status, E1 interface status)
Ver	Show version of the Radio.
Vers	
Version	

Syntactic notes and comments:

- Commands are in **bold** font.
- All arguments (variables) are in *italic* font.
- Subcommands and keywords are in regular font.
- Arguments in square brackets ([ ]) are optional but required arguments are in angle brackets (<>).
- Alternative keywords are grouped in braces ({}) and separated by vertical bars (|).

The management system is automatically restarted if it freezes, this is performed by a watchdog timer (WDT). The system can be resetted using **wdttest** command.

3 Configuring Radio Parameters

3.1 Default ODU Settings

The Full Outdoor Units are shipped with disabled Transmitter (TxPower OFF) and channel is set to one in the middle of respective A or B side of the Low or High subband (model types: LA, HA, LB, HB), or in the middle of the whole Low or High subband (model types: L and H).

3.2 Configuring Tx Frequency

The Tx frequency can be set using "**Channel**" command from ASCII or Telnet management terminal, example: *Channel 22*

The Rx frequency is set automatically depending on the Tx frequency for a given channel plan in which the Full ODU operates.

3.3 Frequency Channel Arrangement

*Table 1. Tx/Rx channel centre frequencies for the CFM series Full Outdoor Unit operating in **13** GHz band with the duplex shift of **266** MHz (frequency is given in MHz). This channel plan conforms to rec. ITU-R F.497-6*

N	LA	HA	N	LB	HB
0	12752,75	13018,75	32	12864,75	13130,75
1	12756,25	13022,25	33	12868,25	13134,25
2	12759,75	13025,75	34	12871,75	13137,75
3	12763,25	13029,25	35	12875,25	13141,25
4	12766,75	13032,75	36	12878,75	13144,75
5	12770,25	13036,25	37	12882,25	13148,25
6	12773,75	13039,75	38	12885,75	13151,75
7	12777,25	13043,25	39	12889,25	13155,25
8	12780,75	13046,75	40	12892,75	13158,75
9	12784,25	13050,25	41	12896,25	13162,25
10	12787,75	13053,75	42	12899,75	13165,75
11	12791,25	13057,25	43	12903,25	13169,25
12	12794,75	13060,75	44	12906,75	13172,75
13	12798,25	13064,25	45	12910,25	13176,25
14	12801,75	13067,75	46	12913,75	13179,75
15	12805,25	13071,25	47	12917,25	13183,25
16	12808,75	13074,75	48	12920,75	13186,75
17	12812,25	13078,25	49	12924,25	13190,25
18	12815,75	13081,75	50	12927,75	13193,75
19	12819,25	13085,25	51	12931,25	13197,25
20	12822,75	13088,75	52	12934,75	13200,75
21	12826,25	13092,25	53	12938,25	13204,25
22	12829,75	13095,75	54	12941,75	13207,75
23	12833,25	13099,25	55	12945,25	13211,25
24	12836,75	13102,75	56	12948,75	13214,75
25	12840,25	13106,25	57	12952,25	13218,25
26	12843,75	13109,75	58	12955,75	13221,75
27	12847,25	13113,25	59	12959,25	13225,25
28	12850,75	13116,75	60	12962,75	13228,75
29	12854,25	13120,25	61	12966,25	13232,25
30	12857,75	13123,75	62	12969,75	13235,75
31	12861,25	13127,25	63	12973,25	13239,25

*Table 2. Tx/Rx channel centre frequencies for the CFM series Full Outdoor Unit operating in **15** GHz band with the duplex shift of **420** MHz (frequency is given in MHz)*

N	LA	HA	N	LA	HA	N	LB	HB	N	LB	HB
0	14502,75	14922,75	30	14607,75	15027,75	60	14712,75	15132,75	90	14817,75	15237,75
1	14506,25	14926,25	31	14611,25	15031,25	61	14716,25	15136,25	91	14821,25	15241,25
2	14509,75	14929,75	32	14614,75	15034,75	62	14719,75	15139,75	92	14824,75	15244,75
3	14513,25	14933,25	33	14618,25	15038,25	63	14723,25	15143,25	93	14828,25	15248,25
4	14516,75	14936,75	34	14621,75	15041,75	64	14726,75	15146,75	94	14831,75	15251,75
5	14520,25	14940,25	35	14625,25	15045,25	65	14730,25	15150,25	95	14835,25	15255,25
6	14523,75	14943,75	36	14628,75	15048,75	66	14733,75	15153,75	96	14838,75	15258,75
7	14527,25	14947,25	37	14632,25	15052,25	67	14737,25	15157,25	97	14842,25	15262,25
8	14530,75	14950,75	38	14635,75	15055,75	68	14740,75	15160,75	98	14845,75	15265,75
9	14534,25	14954,25	39	14639,25	15059,25	69	14744,25	15164,25	99	14849,25	15269,25
10	14537,75	14957,75	40	14642,75	15062,75	70	14747,75	15167,75	100	14852,75	15272,75
11	14541,25	14961,25	41	14646,25	15066,25	71	14751,25	15171,25	101	14856,25	15276,25
12	14544,75	14964,75	42	14649,75	15069,75	72	14754,75	15174,75	102	14859,75	15279,75
13	14548,25	14968,25	43	14653,25	15073,25	73	14758,25	15178,25	103	14863,25	15283,25
14	14551,75	14971,75	44	14656,75	15076,75	74	14761,75	15181,75	104	14866,75	15286,75
15	14555,25	14975,25	45	14660,25	15080,25	75	14765,25	15185,25	105	14870,25	15290,25
16	14558,75	14978,75	46	14663,75	15083,75	76	14768,75	15188,75	106	14873,75	15293,75
17	14562,25	14982,25	47	14667,25	15087,25	77	14772,25	15192,25	107	14877,25	15297,25
18	14565,75	14985,75	48	14670,75	15090,75	78	14775,75	15195,75	108	14880,75	15300,75
19	14569,25	14989,25	49	14674,25	15094,25	79	14779,25	15199,25	109	14884,25	15304,25
20	14572,75	14992,75	50	14677,75	15097,75	80	14782,75	15202,75	110	14887,75	15307,75
21	14576,25	14996,25	51	14681,25	15101,25	81	14786,25	15206,25	111	14891,25	15311,25
22	14579,75	14999,75	52	14684,75	15104,75	82	14789,75	15209,75	112	14894,75	15314,75
23	14583,25	15003,25	53	14688,25	15108,25	83	14793,25	15213,25	113	14898,25	15318,25
24	14586,75	15006,75	54	14691,75	15111,75	84	14796,75	15216,75	114	14901,75	15321,75
25	14590,25	15010,25	55	14695,25	15115,25	85	14800,25	15220,25	115	14905,25	15325,25
26	14593,75	15013,75	56	14698,75	15118,75	86	14803,75	15223,75	116	14908,75	15328,75
27	14597,25	15017,25	57	14702,25	15122,25	87	14807,25	15227,25	117	14912,25	15332,25
28	14600,75	15020,75	58	14705,75	15125,75	88	14810,75	15230,75	118	14915,75	15335,75
29	14604,25	15024,25	59	14709,25	15129,25	89	14814,25	15234,25	119	14919,25	15339,25

*Table 3. Tx/Rx channel centre frequencies for the CFM series Full Outdoor Unit operating in **15** GHz band with the duplex shift of **728** MHz (frequency is given in MHz)*

N	L	H	N	L	H
0	14502,75	15230,75	16	14558,75	15286,75
1	14506,25	15234,25	17	14562,25	15290,25
2	14509,75	15237,75	18	14565,75	15293,75
3	14513,25	15241,25	19	14569,25	15297,25
4	14516,75	15244,75	20	14572,75	15300,75
5	14520,25	15248,25	21	14576,25	15304,25
6	14523,75	15251,75	22	14579,75	15307,75
7	14527,25	15255,25	23	14583,25	15311,25
8	14530,75	15258,75	24	14586,75	15314,75
9	14534,25	15262,25	25	14590,25	15318,25
10	14537,75	15265,75	26	14593,75	15321,75
11	14541,25	15269,25	27	14597,25	15325,25
12	14544,75	15272,75	28	14600,75	15328,75
13	14548,25	15276,25	29	14604,25	15332,25
14	14551,75	15279,75	30	14607,75	15335,75
15	14555,25	15283,25	31	14611,25	15339,25

*Table 4. Tx/Rx channel centre frequencies for the CFM-**18**-**L4** series Radio operating in **18** GHz band with the channel spacing of **3.5** MHz and duplex shift **1010** MHz; the plan corresponds to ITU-R recommendation F.595-7 (Annex 4)*

Channel No.	LA	HA	Channel No.	LA	HA	Channel No.	LB	HB	Channel No.	LB	HB
1	17702,50	18712,50	51	17952,50	18962,50	100	18197,50	19207,50	150	18447,50	19457,50
2	17707,50	18717,50	52	17957,50	18967,50	101	18202,50	19212,50	151	18452,50	19462,50
3	17712,50	18722,50	53	17962,50	18972,50	102	18207,50	19217,50	152	18457,50	19467,50
4	17717,50	18727,50	54	17967,50	18977,50	103	18212,50	19222,50	153	18462,50	19472,50
5	17722,50	18732,50	55	17972,50	18982,50	104	18217,50	19227,50	154	18467,50	19477,50
6	17727,50	18737,50	56	17977,50	18987,50	105	18222,50	19232,50	155	18472,50	19482,50
7	17732,50	18742,50	57	17982,50	18992,50	106	18227,50	19237,50	156	18477,50	19487,50
8	17737,50	18747,50	58	17987,50	18997,50	107	18232,50	19242,50	157	18482,50	19492,50
9	17742,50	18752,50	59	17992,50	19002,50	108	18237,50	19247,50	158	18487,50	19497,50
10	17747,50	18757,50	60	17997,50	19007,50	109	18242,50	19252,50	159	18492,50	19502,50
11	17752,50	18762,50	61	18002,50	19012,50	110	18247,50	19257,50	160	18497,50	19507,50
12	17757,50	18767,50	62	18007,50	19017,50	111	18252,50	19262,50	161	18502,50	19512,50
13	17762,50	18772,50	63	18012,50	19022,50	112	18257,50	19267,50	162	18507,50	19517,50
14	17767,50	18777,50	64	18017,50	19027,50	113	18262,50	19272,50	163	18512,50	19522,50
15	17772,50	18782,50	65	18022,50	19032,50	114	18267,50	19277,50	164	18517,50	19527,50
16	17777,50	18787,50	66	18027,50	19037,50	115	18272,50	19282,50	165	18522,50	19532,50
17	17782,50	18792,50	67	18032,50	19042,50	116	18277,50	19287,50	166	18527,50	19537,50
18	17787,50	18797,50	68	18037,50	19047,50	117	18282,50	19292,50	167	18532,50	19542,50
19	17792,50	18802,50	69	18042,50	19052,50	118	18287,50	19297,50	168	18537,50	19547,50
20	17797,50	18807,50	70	18047,50	19057,50	119	18292,50	19302,50	169	18542,50	19552,50
21	17802,50	18812,50	71	18052,50	19062,50	120	18297,50	19307,50	170	18547,50	19557,50
22	17807,50	18817,50	72	18057,50	19067,50	121	18302,50	19312,50	171	18552,50	19562,50
23	17812,50	18822,50	73	18062,50	19072,50	122	18307,50	19317,50	172	18557,50	19567,50
24	17817,50	18827,50	74	18067,50	19077,50	123	18312,50	19322,50	173	18562,50	19572,50
25	17822,50	18832,50	75	18072,50	19082,50	124	18317,50	19327,50	174	18567,50	19577,50
26	17827,50	18837,50	76	18077,50	19087,50	125	18322,50	19332,50	175	18572,50	19582,50
27	17832,50	18842,50	77	18082,50	19092,50	126	18327,50	19337,50	176	18577,50	19587,50
28	17837,50	18847,50	78	18087,50	19097,50	127	18332,50	19342,50	177	18582,50	19592,50
29	17842,50	18852,50	79	18092,50	19102,50	128	18337,50	19347,50	178	18587,50	19597,50
30	17847,50	18857,50	80	18097,50	19107,50	129	18342,50	19352,50	179	18592,50	19602,50
31	17852,50	18862,50	81	18102,50	19112,50	130	18347,50	19357,50	180	18597,50	19607,50
32	17857,50	18867,50	82	18107,50	19117,50	131	18352,50	19362,50	181	18602,50	19612,50
33	17862,50	18872,50	83	18112,50	19122,50	132	18357,50	19367,50	182	18607,50	19617,50
34	17867,50	18877,50	84	18117,50	19127,50	133	18362,50	19372,50	183	18612,50	19622,50
35	17872,50	18882,50	85	18122,50	19132,50	134	18367,50	19377,50	184	18617,50	19627,50
36	17877,50	18887,50	86	18127,50	19137,50	135	18372,50	19382,50	185	18622,50	19632,50
37	17882,50	18892,50	87	18132,50	19142,50	136	18377,50	19387,50	186	18627,50	19637,50
38	17887,50	18897,50	88	18137,50	19147,50	137	18382,50	19392,50	187	18632,50	19642,50
39	17892,50	18902,50	89	18142,50	19152,50	138	18387,50	19397,50	188	18637,50	19647,50
40	17897,50	18907,50	90	18147,50	19157,50	139	18392,50	19402,50	189	18642,50	19652,50
41	17902,50	18912,50	91	18152,50	19162,50	140	18397,50	19407,50	190	18647,50	19657,50
42	17907,50	18917,50	92	18157,50	19167,50	141	18402,50	19412,50	191	18652,50	19662,50
43	17912,50	18922,50	93	18162,50	19172,50	142	18407,50	19417,50	192	18657,50	19667,50
44	17917,50	18927,50	94	18167,50	19177,50	143	18412,50	19422,50	193	18662,50	19672,50
45	17922,50	18932,50	95	18172,50	19182,50	144	18417,50	19427,50	194	18667,50	19677,50
46	17927,50	18937,50	96	18177,50	19187,50	145	18422,50	19432,50	195	18672,50	19682,50
47	17932,50	18942,50	97	18182,50	19192,50	146	18427,50	19437,50	196	18677,50	19687,50
48	17937,50	18947,50	98	18187,50	19197,50	147	18432,50	19442,50	197	18682,50	19692,50
49	17942,50	18952,50	99	18192,50	19202,50	148	18437,50	19447,50	198	18687,50	19697,50
50	17947,50	18957,50				149	18442,50	19452,50			

*Table 5. Tx/Rx channel centre frequencies for the CFM series Full Outdoor Unit operating in **23** GHz band with the duplex shift of **1008** MHz (frequency is given in MHz)*

N	L	H	N	L	H	N	L	H	N	L	H
0	22004,5	23012,5	42	22151,5	23159,5	84	22298,5	23306,5	126	22445,5	23453,5
1	22008,0	23016,0	43	22155,0	23163,0	85	22302,0	23310,0	127	22449,0	23457,0
2	22011,5	23019,5	44	22158,5	23166,5	86	22305,5	23313,5	128	22452,5	23460,5
3	22015,0	23023,0	45	22162,0	23170,0	87	22309,0	23317,0	129	22456,0	23464,0
4	22018,5	23026,5	46	22165,5	23173,5	88	22312,5	23320,5	130	22459,5	23467,5
5	22022,0	23030,0	47	22169,0	23177,0	89	22316,0	23324,0	131	22463,0	23471,0
6	22025,5	23033,5	48	22172,5	23180,5	90	22319,5	23327,5	132	22466,5	23474,5
7	22029,0	23037,0	49	22176,0	23184,0	91	22323,0	23331,0	133	22470,0	23478,0
8	22032,5	23040,5	50	22179,5	23187,5	92	22326,5	23334,5	134	22473,5	23481,5
9	22036,0	23044,0	51	22183,0	23191,0	93	22330,0	23338,0	135	22477,0	23485,0
10	22039,5	23047,5	52	22186,5	23194,5	94	22333,5	23341,5	136	22480,5	23488,5
11	22043,0	23051,0	53	22190,0	23198,0	95	22337,0	23345,0	137	22484,0	23492,0
12	22046,5	23054,5	54	22193,5	23201,5	96	22340,5	23348,5	138	22487,5	23495,5
13	22050,0	23058,0	55	22197,0	23205,0	97	22344,0	23352,0	139	22491,0	23499,0
14	22053,5	23061,5	56	22200,5	23208,5	98	22347,5	23355,5	140	22494,5	23502,5
15	22057,0	23065,0	57	22204,0	23212,0	99	22351,0	23359,0	141	22498,0	23506,0
16	22060,5	23068,5	58	22207,5	23215,5	100	22354,5	23362,5	142	22501,5	23509,5
17	22064,0	23072,0	59	22211,0	23219,0	101	22358,0	23366,0	143	22505,0	23513,0
18	22067,5	23075,5	60	22214,5	23222,5	102	22361,5	23369,5	144	22508,5	23516,5
19	22071,0	23079,0	61	22218,0	23226,0	103	22365,0	23373,0	145	22512,0	23520,0
20	22074,5	23082,5	62	22221,5	23229,5	104	22368,5	23376,5	146	22515,5	23523,5
21	22078,0	23086,0	63	22225,0	23233,0	105	22372,0	23380,0	147	22519,0	23527,0
22	22081,5	23089,5	64	22228,5	23236,5	106	22375,5	23383,5	148	22522,5	23530,5
23	22085,0	23093,0	65	22232,0	23240,0	107	22379,0	23387,0	149	22526,0	23534,0
24	22088,5	23096,5	66	22235,5	23243,5	108	22382,5	23390,5	150	22529,5	23537,5
25	22092,0	23100,0	67	22239,0	23247,0	109	22386,0	23394,0	151	22533,0	23541,0
26	22095,5	23103,5	68	22242,5	23250,5	110	22389,5	23397,5	152	22536,5	23544,5
27	22099,0	23107,0	69	22246,0	23254,0	111	22393,0	23401,0	153	22540,0	23548,0
28	22102,5	23110,5	70	22249,5	23257,5	112	22396,5	23404,5	154	22543,5	23551,5
29	22106,0	23114,0	71	22253,0	23261,0	113	22400,0	23408,0	155	22547,0	23555,0
30	22109,5	23117,5	72	22256,5	23264,5	114	22403,5	23411,5	156	22550,5	23558,5
31	22113,0	23121,0	73	22260,0	23268,0	115	22407,0	23415,0	157	22554,0	23562,0
32	22116,5	23124,5	74	22263,5	23271,5	116	22410,5	23418,5	158	22557,5	23565,5
33	22120,0	23128,0	75	22267,0	23275,0	117	22414,0	23422,0	159	22561,0	23569,0
34	22123,5	23131,5	76	22270,5	23278,5	118	22417,5	23425,5	160	22564,5	23572,5
35	22127,0	23135,0	77	22274,0	23282,0	119	22421,0	23429,0	161	22568,0	23576,0
36	22130,5	23138,5	78	22277,5	23285,5	120	22424,5	23432,5	162	22571,5	23579,5
37	22134,0	23142,0	79	22281,0	23289,0	121	22428,0	23436,0	163	22575,0	23583,0
38	22137,5	23145,5	80	22284,5	23292,5	122	22431,5	23439,5	164	22578,5	23586,5
39	22141,0	23149,0	81	22288,0	23296,0	123	22435,0	23443,0	165	22582,0	23590,0
40	22144,5	23152,5	82	22291,5	23299,5	124	22438,5	23446,5	166	22585,5	23593,5
41	22148,0	23156,0	83	22295,0	23303,0	125	22442,0	23450,0	167	22589,0	23597,0

*Table 6. Tx/Rx channel centre frequencies for the CFM series Full Outdoor Unit operating in **23** GHz band with the duplex shift of **1232** MHz (frequency is given in MHz)*

N	LA	HA	N	LA	HA	N	LB	HB	N	LB	HB
1	21225,75	22457,75	81	21505,75	22737,75	161	21785,75	23017,75	241	22065,75	23297,75
2	21229,25	22461,25	82	21509,25	22741,25	162	21789,25	23021,25	242	22069,25	23301,25
3	21232,75	22464,75	83	21512,75	22744,75	163	21792,75	23024,75	243	22072,75	23304,75
4	21236,25	22468,25	84	21516,25	22748,25	164	21796,25	23028,25	244	22076,25	23308,25
5	21239,75	22471,75	85	21519,75	22751,75	165	21799,75	23031,75	245	22079,75	23311,75
6	21243,25	22475,25	86	21523,25	22755,25	166	21803,25	23035,25	246	22083,25	23315,25
7	21246,75	22478,75	87	21526,75	22758,75	167	21806,75	23038,75	247	22086,75	23318,75
8	21250,25	22482,25	88	21530,25	22762,25	168	21810,25	23042,25	248	22090,25	23322,25
9	21253,75	22485,75	89	21533,75	22765,75	169	21813,75	23045,75	249	22093,75	23325,75
10	21257,25	22489,25	90	21537,25	22769,25	170	21817,25	23049,25	250	22097,25	23329,25
11	21260,75	22492,75	91	21540,75	22772,75	171	21820,75	23052,75	251	22100,75	23332,75
12	21264,25	22496,25	92	21544,25	22776,25	172	21824,25	23056,25	252	22104,25	23336,25
13	21267,75	22499,75	93	21547,75	22779,75	173	21827,75	23059,75	253	22107,75	23339,75
14	21271,25	22503,25	94	21551,25	22783,25	174	21831,25	23063,25	254	22111,25	23343,25
15	21274,75	22506,75	95	21554,75	22786,75	175	21834,75	23066,75	255	22114,75	23346,75
16	21278,25	22510,25	96	21558,25	22790,25	176	21838,25	23070,25	256	22118,25	23350,25
17	21281,75	22513,75	97	21561,75	22793,75	177	21841,75	23073,75	257	22121,75	23353,75
18	21285,25	22517,25	98	21565,25	22797,25	178	21845,25	23077,25	258	22125,25	23357,25
19	21288,75	22520,75	99	21568,75	22800,75	179	21848,75	23080,75	259	22128,75	23360,75
20	21292,25	22524,25	100	21572,25	22804,25	180	21852,25	23084,25	260	22132,25	23364,25
21	21295,75	22527,75	101	21575,75	22807,75	181	21855,75	23087,75	261	22135,75	23367,75
22	21299,25	22531,25	102	21579,25	22811,25	182	21859,25	23091,25	262	22139,25	23371,25
23	21302,75	22534,75	103	21582,75	22814,75	183	21862,75	23094,75	263	22142,75	23374,75
24	21306,25	22538,25	104	21586,25	22818,25	184	21866,25	23098,25	264	22146,25	23378,25
25	21309,75	22541,75	105	21589,75	22821,75	185	21869,75	23101,75	265	22149,75	23381,75
26	21313,25	22545,25	106	21593,25	22825,25	186	21873,25	23105,25	266	22153,25	23385,25
27	21316,75	22548,75	107	21596,75	22828,75	187	21876,75	23108,75	267	22156,75	23388,75
28	21320,25	22552,25	108	21600,25	22832,25	188	21880,25	23112,25	268	22160,25	23392,25
29	21323,75	22555,75	109	21603,75	22835,75	189	21883,75	23115,75	269	22163,75	23395,75
30	21327,25	22559,25	110	21607,25	22839,25	190	21887,25	23119,25	270	22167,25	23399,25
31	21330,75	22562,75	111	21610,75	22842,75	191	21890,75	23122,75	271	22170,75	23402,75
32	21334,25	22566,25	112	21614,25	22846,25	192	21894,25	23126,25	272	22174,25	23406,25
33	21337,75	22569,75	113	21617,75	22849,75	193	21897,75	23129,75	273	22177,75	23409,75
34	21341,25	22573,25	114	21621,25	22853,25	194	21901,25	23133,25	274	22181,25	23413,25
35	21344,75	22576,75	115	21624,75	22856,75	195	21904,75	23136,75	275	22184,75	23416,75
36	21348,25	22580,25	116	21628,25	22860,25	196	21908,25	23140,25	276	22188,25	23420,25
37	21351,75	22583,75	117	21631,75	22863,75	197	21911,75	23143,75	277	22191,75	23423,75
38	21355,25	22587,25	118	21635,25	22867,25	198	21915,25	23147,25	278	22195,25	23427,25
39	21358,75	22590,75	119	21638,75	22870,75	199	21918,75	23150,75	279	22198,75	23430,75
40	21362,25	22594,25	120	21642,25	22874,25	200	21922,25	23154,25	280	22202,25	23434,25
41	21365,75	22597,75	121	21645,75	22877,75	201	21925,75	23157,75	281	22205,75	23437,75
42	21369,25	22601,25	122	21649,25	22881,25	202	21929,25	23161,25	282	22209,25	23441,25
43	21372,75	22604,75	123	21652,75	22884,75	203	21932,75	23164,75	283	22212,75	23444,75
44	21376,25	22608,25	124	21656,25	22888,25	204	21936,25	23168,25	284	22216,25	23448,25
45	21379,75	22611,75	125	21659,75	22891,75	205	21939,75	23171,75	285	22219,75	23451,75
46	21383,25	22615,25	126	21663,25	22895,25	206	21943,25	23175,25	286	22223,25	23455,25
47	21386,75	22618,75	127	21666,75	22898,75	207	21946,75	23178,75	287	22226,75	23458,75
48	21390,25	22622,25	128	21670,25	22902,25	208	21950,25	23182,25	288	22230,25	23462,25
49	21393,75	22625,75	129	21673,75	22905,75	209	21953,75	23185,75	289	22233,75	23465,75
50	21397,25	22629,25	130	21677,25	22909,25	210	21957,25	23189,25	290	22237,25	23469,25
51	21400,75	22632,75	131	21680,75	22912,75	211	21960,75	23192,75	291	22240,75	23472,75
52	21404,25	22636,25	132	21684,25	22916,25	212	21964,25	23196,25	292	22244,25	23476,25
53	21407,75	22639,75	133	21687,75	22919,75	213	21967,75	23199,75	293	22247,75	23479,75
54	21411,25	22643,25	134	21691,25	22923,25	214	21971,25	23203,25	294	22251,25	23483,25
55	21414,75	22646,75	135	21694,75	22926,75	215	21974,75	23206,75	295	22254,75	23486,75
56	21418,25	22650,25	136	21698,25	22930,25	216	21978,25	23210,25	296	22258,25	23490,25
57	21421,75	22653,75	137	21701,75	22933,75	217	21981,75	23213,75	297	22261,75	23493,75
58	21425,25	22657,25	138	21705,25	22937,25	218	21985,25	23217,25	298	22265,25	23497,25
59	21428,75	22660,75	139	21708,75	22940,75	219	21988,75	23220,75	299	22268,75	23500,75
60	21432,25	22664,25	140	21712,25	22944,25	220	21992,25	23224,25	300	22272,25	23504,25
61	21435,75	22667,75	141	21715,75	22947,75	221	21995,75	23227,75	301	22275,75	23507,75
62	21439,25	22671,25	142	21719,25	22951,25	222	21999,25	23231,25	302	22279,25	23511,25
63	21442,75	22674,75	143	21722,75	22954,75	223	22002,75	23234,75	303	22282,75	23514,75
64	21446,25	22678,25	144	21726,25	22958,25	224	22006,25	23238,25	304	22286,25	23518,25
65	21449,75	22681,75	145	21729,75	22961,75	225	22009,75	23241,75	305	22289,75	23521,75
66	21453,25	22685,25	146	21733,25	22965,25	226	22013,25	23245,25	306	22293,25	23525,25
67	21456,75	22688,75	147	21736,75	22968,75	227	22016,75	23248,75	307	22296,75	23528,75
68	21460,25	22692,25	148	21740,25	22972,25	228	22020,25	23252,25	308	22300,25	23532,25
69	21463,75	22695,75	149	21743,75	22975,75	229	22023,75	23255,75	309	22303,75	23535,75
70	21467,25	22699,25	150	21747,25	22979,25	230	22027,25	23259,25	310	22307,25	23539,25
71	21470,75	22702,75	151	21750,75	22982,75	231	22030,75	23262,75	311	22310,75	23542,75
72	21474,25	22706,25	152	21754,25	22986,25	232	22034,25	23266,25	312	22314,25	23546,25
73	21477,75	22709,75	153	21757,75	22989,75	233	22037,75	23269,75	313	22317,75	23549,75
74	21481,25	22713,25	154	21761,25	22993,25	234	22041,25	23273,25	314	22321,25	23553,25
75	21484,75	22716,75	155	21764,75	22996,75	235	22044,75	23276,75	315	22324,75	23556,75
76	21488,25	22720,25	156	21768,25	23000,25	236	22048,25	23280,25	316	22328,25	23560,25
77	21491,75	22723,75	157	21771,75	23003,75	237	22051,75	23283,75	317	22331,75	23563,75
78	21495,25	22727,25	158	21775,25	23007,25	238	22055,25	23287,25	318	22335,25	23567,25
79	21498,75	22730,75	159	21778,75	23010,75	239	22058,75	23290,75	319	22338,75	23570,75
80	21502,25	22734,25	160	21782,25	23014,25	240	22062,25	23294,25	320	22342,25	23574,25

3.4 Configuring Tx Power

The Tx Power level of the Radio can be adjusted using **Txpower** command from console terminal, example: *Txpower +10*

Although the guaranteed minimum transmitter power is 0 dBm, the Tx power can be adjusted within limits from -10 dBm to +20 dBm in steps of 1 dBm, as well as turned off (*Txpower off*).

To avoid possible interference with other radio equipment, the default setting is "OFF".

4 RSSI Port

RSSI (Received Signal Strength Indicator) port is used to adjust the alignment of antenna for best performance (for both rough and fine adjustment); this can be done using digital multimeter which is connected to the RSSI port. The output of the RSSI port is DC voltage and varies depending on received signal level.

5 Loopbacks

5.1 Radio loopback

Radio (RF) loopbacks can be set on a fixed time interval only; if using LCD/Keypad, the RF loop test is set for 1 minute. If setting RF loop from Telnet or ASCII console, the duration of the loopback mode can be specified from 1 to 10 minutes.

The radio loop is set in the ODU. Radio loopback mode is a special ODU operation mode, where the Rx frequency during the loopback mode is set equal to the Tx frequency. During radio loopback mode, the signal is transmitted and looped back through the duplexer filter to the receiver block. The radio loopback is not dual.

Important note:

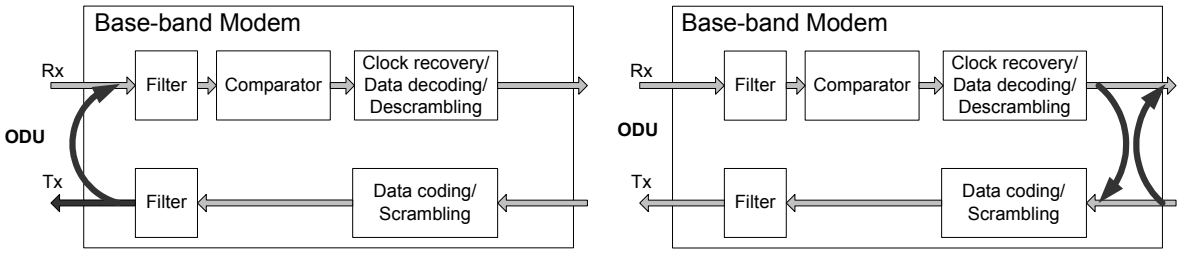
1. Because of the frequency characteristic of the duplexer filter, in order to set the radio loop, the ODUs operating in the Low band side must be switched to the highest available frequency channel, but the ODUs operating in the High band side must be switched to the lowest available frequency channel;
2. Before setting the radio loop, the transmitter power should be switched to maximum level;
3. In CFM-18-FO2E1 unit the radio loopback mode is not available.

5.2 Base-band loopbacks

Base-band loopbacks can be set on a fixed time interval only; if using LCD/Keypad, the base-band loop test is set for 1 minute. If setting base-band loop from Telnet or ASCII console, the duration of the loopback mode can be specified from 1 to 10 minutes.

The baseband loop is set in the baseband modem in the IDU. There are two types of **baseband loopbacks** (both can not be activated simultaneously):

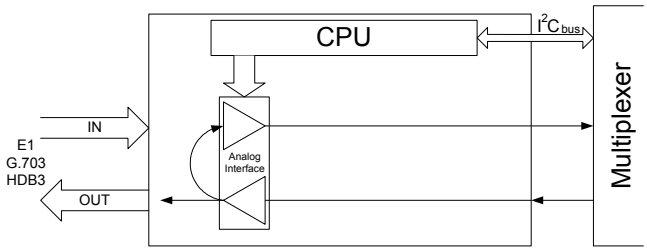
- Digital baseband loopback: the signal from the ODU and from the multiplexer (or Bridge board) in the baseband modem is looped back to the receiving device; the digital baseband loopback is dual (see figure below);
- Analog baseband loopback: the modulated signal on the baseband modem output is immediately looped back to the receiving device.



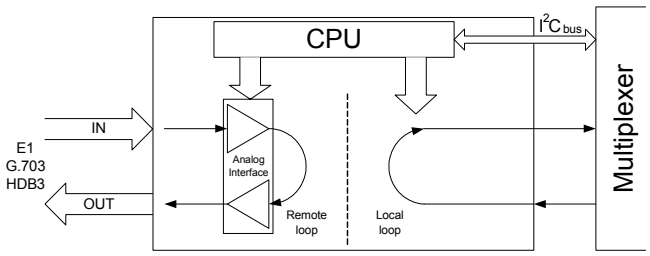
5.3 E1 Interface Loopbacks

The E1 interface module supports analog, digital and remote loopback modes. Only one loopback mode can be set at a time for a single E1 channel.

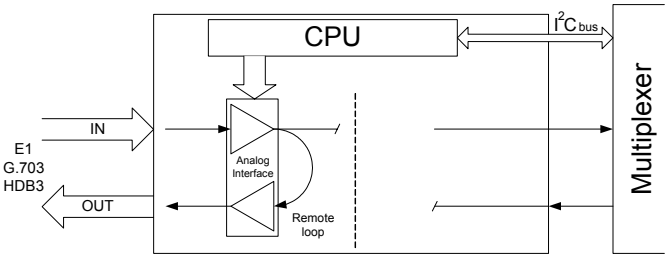
The digital loopback mode is dual since there are two loops closed, remote and local (see figures below).



The E1 interface analog loopback mode



The E1 interface digital loopback mode



The E1 interface remote loopback mode

5.4 Setting Loopbacks from Console

From the remote management terminal, the loopbacks can be activated using the following commands:

- **E1 interface loopback:**

  "Mod # setE1 {Aloop|Dloop}", if argument is *Aloop* analog loopback is activated, whereas *Dloop* activates digital loopback (for details refer to Chapter 5.3), # - MUX slot number.

- **Baseband loopback:**

  "BBloop {on|analog|off} [*duration*]". Duration is set in minutes as values from 1 to 10. If duration is not specified the loopback will be set on 1 minute. There are two baseband loop tests available:

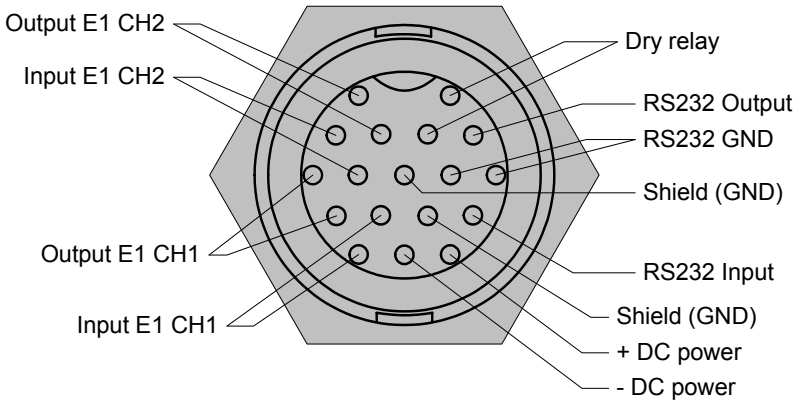
  - Analog: if setting analog loopback, use "bbloop analog" command, analog loopback is not dual.
  - Digital: if setting digital loopback, use "bbloop on" command, digital loopback is dual.

- **RF loopback:**

"RFloop {on|off} [*duration*]", *duration* = 1 min by default.

6 Pinouts

The pinouts for the traffic/management port male connector (on the ODU) are given in the picture below. The pictured pin layout also corresponds to the cable connector solder side.

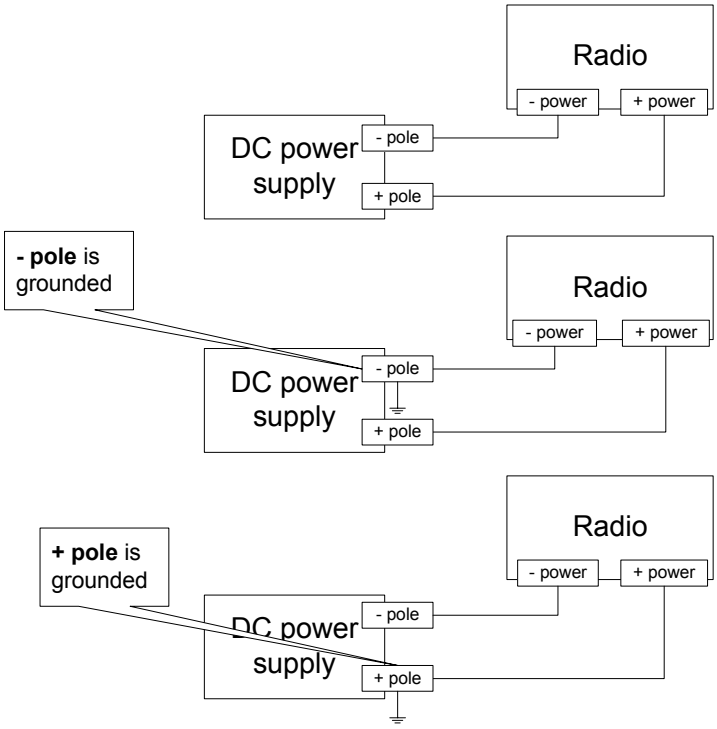


There are 18 pins: 3 pins are used for RS-232 serial interface; 8 pins are used as inputs and outputs for both E1 channels; 2 pins are used for relay, 2 pins for DC supply; 2 "Shield" pins can be used to ground the cable shield if shielded cable is used.

The GND pins are not to be used for lightning protection; there is a special grounding screw (M6) on the front of the unit intended for lightning protection; the Full ODU must be grounded using the grounding screw.

7 Power Supply

The Radio must be supplied with 20…60 VDC, depending on the power supply used the following schemes can be used.



8 SAF Tehnika A/S Contacts

Most up to date contacts of SAF Tehnika A/S could be found at Web site www.saftehnika.com.

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